WE CLAIM:

1. A multi-layer diaphragm for use in a hydraulically driven pump, the diaphragm comprising:

a first layer in contact with a pumped fluid;

a second layer in contact with a hydraulic oil of the pump; and

a third layer including a elastomeric material and an elastomeric conductive trace embedded in the elastomeric material, the third layer being positioned between the first and second layers, the third layer being independently movable relative to the first and second layers.

2. The diaphragm of claim 1, wherein the first layer and second layer include buna rubber.

3. The diaphragm of claim 1, wherein the third layer includes silicone.

4. The diaphragm of claim 1, wherein the conductive trace layer includes carbon and silicone and is capable of resisting/withstanding high levels of strain greater than 20%.

5. The diaphragm of claim 1, wherein the conductive trace is formed as a continuous spiral with opposing ends of the conductive trace being coupled to separate electrical leads.

6. The diaphragm of claim 1, further comprising first and second rings configured to retain the first, second and third layers together.

7. The diaphragm of claim 1, further comprising a lubrication layer positioned between the third layer and first and second layers.

8. The diaphragm of claim 1, wherein the molded third layer includes first and second portions bonded together with the conductive trace positioned between first and second portions.

9. The diaphragm of claim 8, wherein the first portion, second portion and conductive trace each have an outer diameter, the outer diameter of the first portion being greater than the outer diameter of the trace, and outer diameter of the conductive trace being greater than the diameter of the second portion.

10. The diaphragm of claim 1, wherein the first, second and third layers comprise elastomeric materials and are configured to resist rupture under high strain conditions.

11. A method of forming/manufacturing a pump diaphragm, the diaphragm including an elastomeric layer and a conductive trace, the method comprising the steps of:

forming a first portion of the elastomeric layer, the first portion having a primary surface;

forming the conductive trace on the primary surface of the first portion of the elastomeric layer; and

forming a second portion of the elastomeric layer on the primary surface of the first portion over a portion of the conductive trace such that the first and second portions are integral with each other and an outer periphery of the conductive trace is exposed.

12. The method of claim 11, wherein the diaphragm further includes first and second layers, and the method further comprises positioning the elastomeric layer between first and second layers.

13. The method of claim 11, further comprising applying lubricant between the first and second layers and the elastomeric layer.

14. The method of claim 11, wherein the diaphragm further includes a retaining ring, and the method further comprises retaining the first, second and elastomeric layers together.

15. The method of claim 11, wherein the conductive trace is configured as a continuous member having first and second ends, the method further comprising monitoring changes in resistance of the conductive trace when a current source is applied to the conductive trace.

16. The method of claim 15, further comprising generating a failure signal when the change in resistance reaches a predetermined amount.

17. The method of claim 11, further comprising forming the conductive trace using silk screening.

18. The method of claim 11, further comprising forming the elastomeric layer from a material comprising silicone.

19. The method of claim 11, further comprising forming the conductive trace from a material comprising silicone and carbon.

20. The method of claim 11, wherein the step of forming the second portion including a molding, heat bonding, or laminating process.

21. A method of detecting rupture of a diaphragm in a hydraulic pump that includes a first layer, a second layer, and a third layer including a silicone material and an elastomeric conductive trace embedded in the silicone material, the method comprising the steps of:

positioning the first layer in contact with a fluid being pumped by the hydraulic pump;

positioning the second layer in contact with a hydraulic oil of the hydraulic pump;

positioning the third layer between the first and second layers;

applying an electric current to the conductive trace;

detecting variations in electrical resistance resulting from use of the diaphragm in the hydraulic pump, and generating a detection signal; and

shutting off the hydraulic pump when the detection signal is within a predetermined range.

22. The method of claim 21, further comprising the step of coupling the first, second and third layer together at a periphery of the layers with the center portions of the layers being free to move relative to each other.

23. The method of claim 21, wherein the detection signal indicates existence of a failure condition in at least one of the first, second and third layers.

24. The method of claim 21, further comprising exposing the conductive trace only at an outer periphery of the third layer and connecting the electric current to the exposed portion of the conductive trace.

25. The method of claim 21, wherein the hydraulic pump further includes a lubrication layer, and the method further comprises positioning the lubrication layer between the first, second and third layers.

26. A multi-layer diaphragm for use in a hydraulically driven pump, the diaphragm comprising:

a first layer having a first modulus of elasticity;

a second layer having a second modulus of elasticity;

a third layer positioned between the first and second layers and having a third modulus of elasticity lower than the first and second modulus of elasticity; and

an elastomeric conductive trace integral with the third layer and exposed at an outer periphery of the third layer at a location removed from contact with fluids in the pump.

27. The diaphragm of claim 26, wherein the third layer includes silicone and the conductive trace includes silicone and carbon.

28. The diaphragm of claim 27, further comprising first and second rings configured to retain the first, second and third layers together.

29. A hydraulically driven pump, comprising:

a first chamber exposed to a pumped fluid;

a second chamber configured to retain a hydraulic fluid; and

a multi-layer diaphragm positioned between the first and second chambers and including:

a first layer in contact with the pumped fluid;

a second layer in contact with the hydraulic fluid; and

a third layer including an elastomeric base material and an elastomeric conductive trace embedded in the elastomeric base material, the third layer being positioned between the first and second layers and being movable relative to the first and second layers.

30. The pump of claim 29, wherein the elastomeric base material includes silicone and the elastomeric conductive trace includes carbon.

31. The pump of claim 29, wherein changes in an electrical resistance of the conductive trace indicate a failure condition in one of the first, second and third layers.